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Response to Office Action dated December 29, 2004
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Serial No.: 10/054542
Art Unit: 3729
Examiner: Trinh
Docket No. RPS9 2000 0103 US2

REMARKS/ARGUMENTS

Claims 21-40 were pending and examined. Applicant affirms election of claims 21-29, and claims 30-40 have been canceled. The Examiner objected to the Abstract of the specification, and to claim 21. The Examiner rejected claims 21-26, 28, and 29 under 35 USC § 103(a) as being unpatentable over Kwong *et al.* (U.S. Patent No. 66,388,890), hereinafter "Kwong", in view of Takagi *et al.* (U.S. Patent No. 4,800,459), hereinafter "Takagi". The Examiner indicates claim 27 as reciting allowable subject matter if rewritten. In this response, Applicant has amended claims 21 and 27, canceled claims 30-40, and added claims 41 and 42. Claims 21-29, 41, and 42 remain pending.

Specification Objections

The Office Action indicated an objection the Abstract of the specification as filed. In response, Applicant has amended the Abstract to reflect the method claims that are under examination. Applicant submits that the Abstract as amended addresses the objection raised by the Examiner and Applicant would respectfully request the Examiner to reconsider and withdraw the objection.

Claim Objections

The Office Action indicated an objection to an informality in claim 21 as filed. In response, Applicant has amended claim 21 along the lines helpfully suggested by the Examiner. This amendment is made for purposes of improving clarity and is not made for any reason related to patentability. Applicant wishes to thank the Examiner for diligently reviewing the application and discovering this error. Applicant submits that claim 21 as amended addresses the objection raised by the Examiner and Applicant would respectfully request the Examiner to reconsider and withdraw the objection.

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Claim rejections under 35 USC § 103(a)

The Examiner rejected claims 21-26, 28, and 29 under Section 103(a) as being unpatentable over Kwong in view of Takagi.

In response to the rejection of claim 21, Applicant respectfully traverses the rejection because the cited references do not teach or suggest all of the claim limitations. A Section 103(a) rejection is appropriate only when the cited references teach or suggest all of the claim limitations. MPEP 2143.03.

The Section 103(a) rejection is improper in this case because the cited references do not disclose or suggest the limitations wherein the first via is part of a signal path that carries a signal from the first layer to the second layer and where the second via is part of a reference path configured to carry the same signal from a third layer to a fourth conductive layer. This is an important aspect of the invention. The invention is particularly suitable for addressing electromagnetic interference for a high frequency signal propagated over a printed circuit board transmission line that includes a signal path and a reference path. In other words, there is a relationship between the signal path and the reference path.

The relationship between the signal path and the reference path is recited in claim 21. Specifically, claim 21 recites that the first via is part of a signal path that carries the signal from the first layer to the second layer and the second via is part of the reference path that carries said signal from a third layer to the fourth layer (through an embedded electronic component).

The cited references do not teach or suggest a the claimed relationship between their conductive layers. In rejecting claim 21, the Office Action indicates that Kwong teaches the claimed limitation. Kwong (FIG 1) discloses four fourth signal layers 16a, 16b, 16c, and 16d. Kwong also discloses a first via 20 that connects signal layers 16b and 16c and a second via 24 that connects signal layers 16a and 16d. What Kwong does not show, however, is any relationship between the signal that is carried from layer 16a to 16d by via 24 and the signal carried from layer 16b to 16c by via 20.

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Kwong contains no such teaching or suggestion because Kwong is not concerned with reducing electromagnetic interference in a transmission line comprised of a signal path and a reference path. Kwong is concerned with increasing the number of electrical connections that may be made between electronic components on a multilayer printed board without increasing the number of layers in the board. See, e.g., column 2, lines 9-14. Routing a signal through four layers of a multilayer printed circuit board, as is done in claim 21, is contrary to the goal of Kwong, which is to conserve the number of layers in a multilayer circuit board. Whereas claim 21 explicitly recites the use of four layers to propagate a signal using a signal path and a reference path, Kwong is expressly concerned with minimizing the number of layers. Accordingly, Applicant submits that the cited references do not teach or suggest all of the limitations of claim 21.

In addition to the foregoing, Applicant traverses the Section 103(a) rejection of claim 21 because there is no motivation or suggestion to modify Kwong to incorporate the embedded electronic elements of Takagi. The Examiner correctly acknowledges that Kwong fails to teach or suggest the embedded electronics of Takagi. Supporting the combination of Kwong and Takagi, the Office Action states only that it would have been obvious to employ Takagi's teaching of embedding an electrical component within the via in the invention of Kwong "in order to form a desired structure which meet (sic) manufacturing requirements."

Applicant submits that one skilled in the art having the benefit of Kwong would not be motivated to incorporate the embedded electronics of Takagi because embedding the electronics as was done in Takagi does not further the stated purpose of Kwong, which is to conserve the number of layers in a multilayer printed circuit board. While the embedded electronic components of Takagi reduce the area required to implement a particular circuit, Kwong is expressly directed towards techniques for reducing the number of layers rather than the area of a circuit. In the absence of any teaching or suggestion to combine the references, the Section 103(a) rejection under consideration is the product of impermissible hindsight, wherein the claim limitations are used to identify references disclosing or suggesting some or all of the claimed elements. Accordingly, Applicant would respectfully request the Examiner to reconsider and withdraw the Section 103(a) rejection of claim 21 and its dependent claims.

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In addition to the foregoing, Applicant has amended claim 27 to incorporate the limitations of originally presented claim 21. Consistent with the Examiner's appropriate determination that previously presented dependent claim 27 recited allowable subject matter, Applicant submits that independent claim 27 as amended herein recites allowable subject matter.

In addition to the foregoing, Applicant has added new claims 41 and 42. Independent claim 41 recites a method for reducing impedance of a transmission line in a multilayer printed circuit board. The claim recites forming the circuit board to include first, second, third, and fourth conductive layers where the first and second layers form a signal path of the transmission line and the third and fourth layers form a reference path of the transmission line. A first via is formed to connect the first and second layers and a second via is formed to connect the third and fourth layers. Forming the second via includes embedding a capacitor in the via between the third and fourth layers. Because support for these limitations are found in the description of FIG. 2 in the originally submitted application, the new claim does not introduce new matter.

Claim 41 recites elements that are neither taught nor suggested by the cited references. Specifically, the recitation of a transmission line comprised of a signal path implement using a first and second layer connecting by a first via and a reference path comprises of third and fourth layers connected by a second via where the second via includes a capacitor distinguishes the claimed matter from the teachings of the cited references. Neither Kwong nor Takagi teach or suggest a method of reducing impedance in a transmission path by embedding an electronic circuit in the via. Kwong, as discussed above, does not teach or suggest reducing the impedance of a transmission line because Kwong does not even teach or suggest the use of a capacitor or other electronic element in its vias. With respect to Takagi, the electronic elements disclosed therein are clearly intended to increase the impedance of the resulting circuit. In fact, the resulting circuit in Takagi may be fairly characterized as an impedance circuit, comprised of a capacitance in parallel with a resistance. In contrast, embedding the capacitor in a via of the reference path as recited in the claim under discussion has the effect of reducing the impedance of the reference path and thereby reducing impedance mismatches that can produce electromagnetic interference. Because there is no teaching or suggestion in either of the cited

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references for embedding a capacitor in the reference path of a transmission line, Applicant believes that claim 41 recites matter that is allowable over the cited references.

In addition, Applicant has added dependent claim 42, which recites that the signal path of claim 41 is implemented in the top and bottom layers of the circuit board while the reference path is implemented in layers that are adjacent to the top and bottom layers respectively. Support for this claim is found in the specification as filed at, for example, the paragraph beginning on page 9, line 1. This limitation is neither taught nor suggested by the cited references. Kwong discloses that its top and bottom layers 12 and 14 are power and ground planes (except for contact pads and test signals) and, accordingly, those layers cannot comprise the signal path of a transmission line since the disclosed transmission line refers to a transmission line for an AC signal. Takagi does not disclose any conductive layer on the bottom of its substrate. Accordingly, Applicant submits that claim 41 recites matter neither taught nor suggested by the cited references.

CONCLUSION

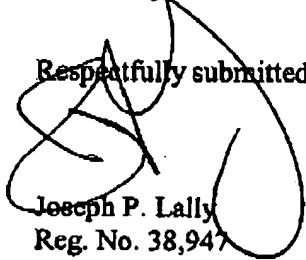
In the present response, Applicant has addressed the objections to the specification and claims, and responded to the Examiner's claim rejections under 35 USC § 103(a). Accordingly, Applicant believes that this response constitutes a complete response to each of the issues raised in the office action. In light of the amendments made herein and the accompanying remarks, Applicant believes that the pending claims are in condition for allowance. Accordingly, Applicant would request the Examiner to withdraw the rejections, allow the pending claims, and

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advance the application to issue. If the Examiner has any questions, comments, or suggestions, the undersigned attorney would welcome and encourage a telephone conference at 512.428.9872.

Respectfully submitted,


Joseph P. Lally
Reg. No. 38,947
ATTORNEY FOR APPLICANT(S)

LALLY & LALLY, L.L.P.
P.O. Box 684749
Austin, Texas 78768-4749
512.428.9870
512.428.9871 (FAX)

JPL/amen

Attachments